B.E MECHANICAL ENGINEERING (PART TIME) FIRST YEAR SECOND SEMESTER-2017

Subject: ENGINEERING MECHANICS-IV

Time: 3 hours Full Marks: 100

Answer any *five* questions

1. Find the eccentricity 'e' of the Shear Center 'S' for the channel section as shown in fig.1. The shear stress distribution V= 100 N. All dimensions are in mm. (20)

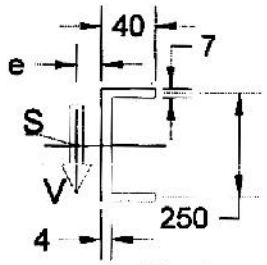

Fig.1

2. A thick cylinder having of 200 mm outside and 140 mm diameter respectively subjected to an internal pressure of 40 MPa and an external pressure of 24 MPa. Determine the maximum shear stress of the material at the inside diameter of the cylinder. Also deduce the governing theory to solve the above problem. (5+15=20)

3. a. Find the tangential velocity, normal and tangential acceleration of a point A on a rigid body rotating at an angular speed of 'ω' about a fixed axis passing through O. The radius vector of A from O is r.

b. The pinion A of the hoist motor drives gear B which is attached to the hoist drum as shown in fig.2. The load L is lifted from its rest position and acquires an upward velocity of 2m/sec in a vertical rise of 800mm with a constant acceleration. As the load passes the position compute (a) the acceleration of point C on the cable in contact with the drum and (b) the angular velocity and acceleration of pinion A. P.C.D of pinion and gear are 200 and 600 mm respectively. The drum diameter is 800mm. (5+15=20)

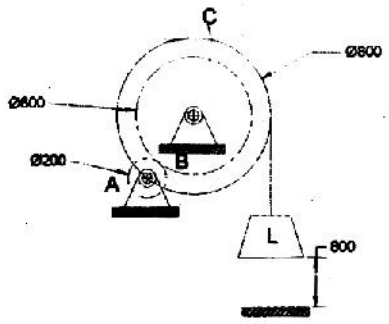

Fig.2

4. a Prove that the total angular acceleration, $\alpha = d\omega/dt + \omega d\theta/dt$, symbol has their own meanings.

b. The rotor of a turbine of a ship has a mass of 2000 kg and rotates at a speed of 3000 rpm clockwise when viewed from stern. The rotor has a radius of gyration 0.6m. Determine The gyroscopic couple and its effects when i) the ship steers left in a curve of 90m radius at a speed of 18 knots (1 knot= 1860 m/hr), ii) the ship pitches 7^0 above and below the normal position and bow is descending with its maximum velocity, -pitching motion is simple harmonic with a period of 50 sec. iii) the ship rolls and at the instant angular velocity is 0.5 rad/sec clockwise when viewed from stern.

Also find the maximum angular acceleration during pitching. (5+15=20)

5. A vertical bar AB of mass 150 kg. with the mass center G midway between ends. The bar is elevated from rest at $\theta=0^0$ by means of parallel link of negligible mass with a constant couple M = 5 KN.m applied to the lower link at C. Determine the angular acceleration α of the lower link as a function of θ and the force at B in the link BD at an instant when $\theta=30^0$. 20

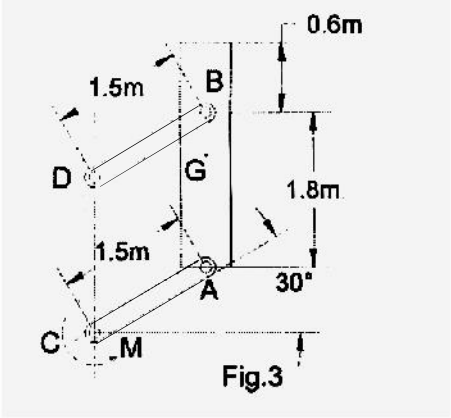

Fig.3

6. A circular disc mounted on a shaft carries three attached masses of 4 kg, 3 kg and 2.5 kg at radial distances of 75mm, 85mm and 50mm and at angular positions of 45^0, 135^0 and 240^0 respectively. The angular positions are measured anti-clockwise from the reference line along x-axis. Determine whether the system is a balance condition or not. If no, find the balance mass and its radial distance. 20